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Students' Perceptions, Creative Thinking Skills, and Practicum Results in Online and Offline Models

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Abstract: This study aims to describe perceptions, practicum results, and students' creative thinking skills in online and offline practicums. This research is ex post facto. The subjects of this study were 70 students of the 2016 and 2017 batches of the Department of Biology Education, University of Muhammadiyah Malang. The two batches experienced different treatments; the 2016 batch took offline practicums, while the 2017 batch took practicums online due to the Covid-19 pandemic. The research instruments consisted of (1) student perception sheets, (2) tests, and (3) creative thinking skills assessment instruments. Data were analyzed descriptively and inferentially using one-way ANOVA and Hotelling's T2. The study results show students' perceptions of offline and online practicum. Students tend to understand the material better in offline practicum than online, and students also think that offline practicum is more interesting than online. Other findings indicate that students find it difficult to understand procedures in online practicums compared to offline ones. In addition, students experience technical problems in offline practicums, especially those related to networks. In contrast, technical issues can be overcome in online practicums because students can consult directly with practicum assistants. Analysis of student practicum results shows no difference between offline and online practicum results from the aspects of understanding and activeness. Meanwhile, from the aspect of report value, the online practicum is better than the offline one. This study also shows that students' creative thinking skills in offline practicums are higher than online in terms of the four aspects of creative thinking and three aspects of assessment, namely data analysis, work methods, and lists of references. In general, student perceptions, practicum results and creative thinking skills in offline practicums are better than in online ones.

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Introduction

Creative thinking skills are related to the ability of people to use their thinking to find new things and ideas (Turiman et al., 2012). Creative thinking skills have strategic value in the 21st century (Sugiyanto & Masykuri, 2018) and are very important in creating new ideas and finding alternative solutions in solving problems (Dewi & Mashami, 2019). Guilford (1975) divides creative thinking skills into four, namely fluency, flexibility, originality, and elaboration, while Torrance (1977) adds these skills with redefinition so that they increase to five parts (Sugiyanto & Masykuri, 2018; Anwar et al., 2012). Fluency relates to the ability to express several ideas or ideas, flexibility relates to the ability to come up with different ideas, originality relates to the ability to create new ideas, and elaboration relates to the ability to detail ideas (Choridah, 2013).

Students' creative thinking skills need to be trained because they are one of the life skills required for the 21st century (Gafour & Gafour, 2021). Previous researchers have tried

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to cultivate and develop students' creative thinking skills through the implementation of learning models (Mardhiyana & Sejati, 2016), the use of e-learning designs (Prasistayanti et al., 2019), the application of Augmented Reality technology (Mardiyah et al., 2020), and the use of practicum method (Alwi & Suherman, 2020). Several previous studies have shown mixed results in connection with the use of practicum methods in improving students' creative thinking skills. Hermansyah et al. (2015) reported that virtual practicum could improve students' creative thinking skills, while Alwi & Suherman (2020) revealed that real practicum positively affects students' creative thinking skills. The differences in the results of these studies have encouraged other researchers to compare the effectiveness of online and offline practicums in improving students' creative thinking skills. Widodo et al. (2016) reported that real practicum significantly influences students' creative thinking skills compared to online practicum. On the other hand, exploring students' perceptions of online and offline practicums is essential as a basis for exploring and strengthening the practicum results obtained by students.

Differences in the results of previous studies are essential to reveal the effectiveness of online and offline practicums. Both of these models have their strengths and weaknesses, so no one model is claimed to be the most effective for improving students' creative thinking skills. This study aims to describe perceptions, practicum results, and students' creative thinking skills in online and offline practicums. This research is a theoretical basis for finding the right formulation to develop hybrid practicums (online and offline).

Research Method

This research is an ex-post facto (Sappaile, 2010), which reveals perceptions, practical results and students' creative thinking skills through offline and online practicums. The subjects of this study were students of the 2016 and 2017 batches of the Biology Education Department, University of Muhammadiyah Malang. The two batches experienced different treatments; the 2016 batch took offline practicums, while the 2017 batch took practicums online due to the Covid-19 pandemic. The practicum activity involved 70 students taking the Environmental Knowledge course. Offline and online practicum activities are presented in Table 1.

Table 1. Differences in Offline and Online Practicum Activities

No.	Online Practicum Activities	Offline Practicum Activities
1.	Practitioners are explained using the website for online practicum activities	The practitioner studies the manual before carrying out the offline practicum
2.	Practitioners study the practicum material presented in the video that has been provided on the website	Practitioners make direct observations in the laboratory following practicum material and are accompanied by practicum assistants
3.	Practice analyzing video observations according to the material	Practitioners doing practicum according to their respective chapters
4.	The practitioner conducts a 40-minute discussion to solve the problem according to the practicum material provided	The practitioner writes down the results of observations and conducts discussions to solve problems according to the practicum material provided
5.	Practitioners are given 20 minutes to ask questions on things that have not been understood in practicum activities	Practitioners convey questions and problems encountered in observations to practicum assistants

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	The practitioner concludes the results of the observations	The practitioner makes conclusions based on real observations that have been made
6.	At the end of the session, the practitioner is given a post-test through an online application	At the end of the session, the practitioner is given reinforcement by the practicum assistant and post-test
7.	The practitioner makes a practicum report in the form of a video analysis of practicum material	The practitioner prepares a practicum report based on the observations that have been made
8.	The report that the practitioner has prepared is then uploaded on the website that has been provided and then assessed by the practicum assistant coordinator.	The practicum assistant coordinator then assesses reports that have been prepared.

The research instruments consisted of (1) student perception sheets, (2) tests, and (3) creative thinking skills assessments. Student perception sheets are used to identify student opinions regarding offline and online practicum, including understanding related to practicum activities, the flexibility of activities, and technical activities. This instrument is given when students have finished doing practicum activities. The test instrument is used to measure the results of student practicums seen from three aspects: understanding, activeness, and report value. Assessment of creative thinking skills refers to Torrance (1977), namely fluency, flexibility, originality, and elaboration, with a rubric adopted by Widodo et al. (2016). The rubric of creative thinking skills is shown in Table 2.

Table 2. Rubric for assessing creative thinking skills

Aspect	Answer	Score
Flexibility	If the answers given cover three or more different areas	3
	If the answers given cover two different areas	2
	If the answers given cover 1 area	1
	If the answer given is illogical or does not answer	0
Elaboration	If the answers given are specific and accompanied by additional explanations	3
	If the answer given is specific, but there is no additional explanation	2
	If the answer given is general	1
	If there is no answer	0
Fluency	When giving five or more logical ideas	3
	When giving 3 - 4 logical ideas	2
	When giving 1-2 logical ideas	1
	If you don't give a logical idea or don't answer	0
Originality	When giving three or more unique and completely new ideas	3
	When giving two unique and completely new ideas	2
	When giving one idea that is unique and completely new	1
	If the answer given is not unique and new or does not answer	0

Research data were analyzed using descriptive and inferential statistics. Descriptive statistics are used to describe student perceptions regarding offline and online practicums. While inferential statistics use one-way ANOVA (Sawyer, 2009) and post hoc test (Hilton & Armstrong, 2006) to reveal the results of student practicum (offline and online), which are reviewed from three aspects, namely comprehension, activity, and report value. In addition,

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Hotelling's T2 (Srivastava, & Mudholkar, 2001; Willems et al., 2002) was also used to determine the effect of offline and online practicum on four aspects of creative thinking skills.

Results and Discussion

Analysis of Student Perceptions in Offline and Online Models

The student perception questionnaire analysis results regarding the implementation of online and offline practicums are presented in Table 3.

Table 3. Summary of Student Perceptions of Practicum Activities

Aspect	Online practicum	Offline practicum
Understanding	Most students think it is not easy to understand the work procedures and material being practised	The material can be understood well, work procedures are clear, and activities are more interesting because they come into direct contact with practicum materials
flexibility	Not all material can be done through online practicum; most students think they experience confusion when they don't understand procedures because of limited interaction with laboratory assistants	Students think that real practicum is more fun because they can ask questions directly related to procedures or material that they have not understood to the laboratory assistant
Technical	Students need more time to understand practicum procedures because they have to analyze the videos presented. In addition, unstable signal constraints in several areas made communication not smooth.	Students are of the opinion that there are no technical obstacles in real practicum, because at any time students can interact with laboratory assistants if they experience difficulties in practicum.

The analysis of student perceptions about online and real practicums in Table 3 shows that most students are more inclined and happy to participate in real practicums than online practicums. In the aspect of understanding, students in real practicums argue that they understand more about work procedures and materials than in online practicums. From the aspect of flexibility, real practicums give students a feeling of pleasure because they can interact directly with practicum materials. In contrast, in online practicums, students tend to experience difficulties due to limited interaction. On the technical aspect, it was revealed that students needed more time to understand the procedures and practicum material presented in the video. In addition, students also experience technical problems related to unstable internet signals in several areas where students come from.

The results of this study are different from previous findings. Lisa et al. (2021) found that online learning effectively improved students' practicum skills. Furthermore, Muthuprasad et al. (2021) revealed that the flexibility and convenience of online classes make them an attractive option for students in India. This result is a finding that student perspectives in online learning, such as practicums, are relative and not fully accepted by students because they require adjustments according to existing conditions. This is in line with the recommendations by Wilcox & Lock (2017), which suggest the need for openness and flexibility to adapt to the ever-changing nature of technology in online practicums.

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Analysis of Student Practicum Results

Student practicum results are measured based on three variables: understanding, activity, and report value. In summary, the results of the analysis of these three variables in online and offline practicums are presented in Table 4.

Table 4. Summary of student practicum results

Variable	Practicum		F statistic	p-value	Tukey HSD p-value	Tukey HSD inference
	Online	Offline				
Understanding	67.90	69.70	0.4636	0.4984	0.4984217	insignificant
Activeness	59.30	60.40	1.0406	0.3115	0.3115322	insignificant
Report value	90.90	75.00	5.3891	0.0235	0.0234575	significant

Table 4 shows that the level of student understanding in online and offline classes is not significantly different (p=0.49). In addition, there was no significant difference between the level of student activity in online and offline classes (p=0.31). In contrast to the other two variables, the report value variable indicates a difference between the two experimental models. The value for the report variable in the online class is higher than in the offline class (p=0.02). Based on students' perceptions of online practicum, most students find it difficult to understand the work procedures provided, but the results of an analysis of students' understanding of practicum material show that there is no difference in students' ability to understand practicum material both online and offline, even though the average grade in the offline class is slightly higher than online classes (Table 4). Likewise, with the activeness variable, it was found that students in online and offline classes had an insignificant level of activity between the two.

Differences in students' perceptions of online practicum and practicum results obtained may be caused by students' lack of familiarity with doing practicum online. Thus, at the beginning of student activities tend to have unfavourable perceptions related to online practicum. Furthermore, students try to adapt to circumstances that result in students getting used to doing it. This is in accordance with the findings of Qonita et al. (2021), which revealed that online practicum experienced fewer difficulties even though several internal obstacles were found, such as lack of motivation, attention and interest, but were classified as small obstacles. The same thing was also revealed by Sari et al. (2019), who revealed that students have a positive attitude in doing online practicums. The results of this study are also supported by the findings of Lisa et al. (2021), which reveal that online practicum can improve students' practicum skills. In addition, students' performance in online and offline classes is also the same; even in some cases, the results in online practicums are better than traditional (offline) models (Rowe et al., 2018). This study reinforces the results of previous research, which revealed that the results of evaluating reports in online classes were higher than in offline practicums (p=0.02). This is allegedly caused because students tend to start adjusting to the situation to adapt well to the online environment.

Student Creative Thinking Skills

This study measures creative thinking skills in four aspects of assessment: method of work, data analysis, discussion and list of references. The Hotelling test was conducted to test the effect of online-offline practicum on each indicator of creative thinking, namely flexibility, elaboration, fluency and originality in the four aspects of assessing creative thinking skills. The results of the analysis of the variance-covariance matrix for online-offline practicum and students' creative thinking abilities in each aspect of the assessment are shown in Table 5.

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Table 5. The Results of the Homogeneity Analysis of the Variance-Covariance Matrix of Online-Offline Models on the Four Aspects of Creative Thinking Skills.

Dependent Variable	Independent Variable				
	Aspects of assessment of creative thinking skills	F	df1	df2	Sig.
Box's M = 17.515	Data analysis	1.496	10	4302.789	.134
Box's M = 14.322	Procedure	1.224	10	4302.789	.270
Box's M = 13.515	Discussion	1.124	10	4302.789	.312
Box's M = 6.305	References	.539	10	4302.789	.864

Based on Table 3, the Box's Test of Equality of Covariance Matrics shows that the variance-covariance matrix between online-offline learning is homogeneous (Sig. ranges from .134 to .864 >.05). Based on these results, further analysis using the Hotelling Test T2 can be carried out (Table 6).

Table 6. Results of the Hotelling Test T2 analysis

Aspects of assessment of creative thinking skills	Effect		Value	F	Sig.	Partial Eta Squared
Data analysis	Group	Pillai's Trace	.411	4.711[a]	.005	.411
		Wilks' Lambda	.589	4.711[a]	.005	.411
		Hotelling's Trace	.698	4.711[a]	.005	.411
		Roy's Largest Root	.698	4.711[a]	.005	.411
Procedure	Group	Pillai's Trace	.542	7.986[a]	.000	.542
		Wilks' Lambda	.458	7.986[a]	.000	.542
		Hotelling's Trace	1.183	7.986[a]	.000	.542
		Roy's Largest Root	1.183	7.986[a]	.000	.542
Discussion	Group	Pillai's Trace	.067	.488[a]	.745	.067
		Wilks' Lambda	.933	.488[a]	.745	.067
		Hotelling's Trace	.072	.488[a]	.745	.067
		Roy's Largest Root	.072	.488[a]	.745	.067
References	Group	Pillai's Trace	.637	11.860[a]	.000	.637
		Wilks' Lambda	.363	11.860[a]	.000	.637
		Hotelling's Trace	1.757	11.860[a]	.000	.637
		Roy's Largest Root	1.757	11.860[a]	.000	.637

The results of the Hotelling Test T2 analysis (Table 6) on three aspects of assessing creative thinking skills, namely data analysis, work methods and reference lists, have Hotelling's Trace values ranging from .698 to 1,757 with a significance value below .05. Meanwhile, the other aspect, namely the discussion aspect, has a Hotelling's Trace value of .072 with a significance of .745 (>.05). The Hotelling Test T2 analysis shows that there is an effect of online-offline practicum on the four indicators of creative thinking skills in the aspects of data analysis, work methods and lists of references, while in the discussion aspect, online-offline practicum has no significant effect. A post hoc test was carried out to strengthen these results, which is shown in Table 7.

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Table 7. Results of Post Hoc Analysis of the Influence of Online-Offline Practicum on Three Indicators of Creative Thinking Skills

Pairwise Comparisons								
Assessment aspect	Creative thinking skills indicator	Group_kelas		Mean Difference (A-B)	Std. Error	Sig.[a]	Mean	
		(A)	(B)				online	offline
Data analysis	Originality	Offline	Online	12.503*	5.161	.022	50.00	62.50
Procedure	Fluency	Offline	Online	1.563*	.307	.000	33.06	34.63
	Originality	Offline	Online	1.563*	.376	.000	33.00	34.56
References	Originality	Offline	Online	2.688*	.401	.000	32.94	35.63

*. The mean difference is significant at the .05 level.

The results of the post hoc analysis in Table 7 show differences in students' creative thinking abilities in online and offline practicums in terms of originality and fluency indicators in three assessment aspects: data analysis, work methods and lists of references. Meanwhile, the other two indicators, namely flexibility and elaboration, did not show significant differences. In data analysis, students' creative thinking ability in offline practicum is higher than online in terms of originality. This trend can also be seen in the aspects of work methods and lists of references which show that students' ability to think creatively in offline practicums is higher than in online practicums in terms of originality and fluency.

Overall, offline practicums have a better impact on creative thinking skills than online practicums in terms of originality and fluency. The high score on the originality indicator in the offline practicum illustrates that students are freer to explore than in the online practicum. This result was reinforced by student perceptions which revealed that most students were confused and did not understand procedures in online practicums. On the other hand, students thought that real practicums were more fun because they could ask questions directly related to procedures or material they had not understood to the laboratory assistants. In addition, students find offline practicums more interesting because they interact directly with practicum materials.

The results of this study corroborate the research of Widodo et al. (2016), which revealed that the average score of real practicum results was better than virtual practicum. In addition, offline practicum can also improve students' creative thinking skills in flexibility, fluency, elaboration and originality. The same results were also reported by Ermayanti & Santri (2020), revealing that students' creative thinking skills in real practice belonged to the good or creative category. The results of this study indicate that students' creative thinking skills in offline practicums are better than in online practicums. However, these results cannot be used as the sole basis for claiming offline practicum is better than online because each has advantages and disadvantages. According to Widodo et al. (2016), an analysis of students' creative thinking skills in offline and online practicums is needed to find a suitable formulation in combining the two to produce a suitable model.

Conclusion

The study results show students' perceptions of offline and online practicum. Students tend to understand the material better in offline practicum than online; students also think that offline practicum is more interesting than online. Other findings indicate that students find it difficult to understand procedures in online practicums compared to offline ones. In addition, students experience technical problems in offline practicums, especially those related to networks,

while in online practicums, technical problems can be overcome more because students can consult directly with practicum assistants. Analysis of student practicum results shows no difference between offline and online practicum results from the aspects of understanding and activeness. Meanwhile, from the aspect of report value, the online practicum is better than offline. This study also shows that students' creative thinking skills in offline practicums are higher than online in terms of the four aspects of creative thinking and three aspects of assessment, namely data analysis, work methods, and lists of references. In general, student perceptions, practicum results and creative thinking skills in offline practicums are better than in online ones.

Recommendation

This research is limited to online and offline practicum activities; further researchers can implement other models, methods or strategies to improve students' creative thinking skills.

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